

## Lab Assignment

### Background

A Steel Company produces pig iron through blast furnace route. The major raw materials used by the company for their production of pig iron from blast furnace are:

1. *iron ore (hematite),*
2. *flux (limestone and dolomite),*
3. *coke.*

The company observed that due to the lack of supply of good quality of coal and iron ore, and the drastic hike of prices of these raw materials making their pig iron production uneconomical. Company also found instead iron ore fines are abundantly available at low cost. Therefore, they have decided to utilize the iron ore fines in the form of sinter with the appreciation that the use of sinter in blast furnace would increase the rate the production and reduce the coke rate.

the company has developed one sinter plant to produce sinter. Input to the sinter plant that they used for production of sinter are iron ore fines, lime and dolomites fines, coke breeze, mill scale, quick lime, blast furnace return, cold sinter return, hot sinter return, flue dust from blast furnace and ESP dust.

The company has performed several trials to get the required properties of sinter, but they have observed that the sinters produced in their sinter plant have irregular characteristics (measured by basicity ratio ( $CaO\% + MgO\%/SiO_2\%$ ), tumbling index (TI) and reduction degradation index (RDI) even after maintaining uniform operational parameter. The details compositional and sinter property data obtained during the trial period is provided to you. You are as Metallurgical Engineer with data expertise in data science given the assignment to analyse the data of the trial period for fixing the irregularity of the sinter characteristics that can be used for production of pig iron through blast furnace route.

Data description: 1. Find your data in **SinterTrialData.csv** file. 2. The file contains the data in the form of a table, col 1 is date of trial, next few columns represent compositional information of the sinter plant inputs which are your features in this case, and later three columns are sinter characteristics. In this context **Basicity Index** is defined as the ( $CaO\% + MgO\%/SiO_2\%$ ) ratio, If this ratio exceeds 1, the sinter is basic; if it is less than 1, it is acidic. **Tumbling Index** is a relative measure of the resistance of the material to breakage or degradation by impact. While the **reduction disintegration index (RDI)** is defined as a quantitative measure of the disintegration of the sinter that could occur in the upper part of the blast furnace after some reduction. Low values are desirable for this index. We appreciate detail study about sintering process and these indexes for more clarity of the data set and the subject.

Your task: Apply your data science practicing knowledge to address the following problem. You may apply any tools and techniques that is discussed in lecture session, or you have learnt from any other resources. All the codes should be developed in google colab platform only. Also you are requested to share the same to my google account attached with email id [sganguly.mme@nitrr.ac.in](mailto:sganguly.mme@nitrr.ac.in) before lab exam.

**Problem statement:**

1. Do the necessary data analysis to check the **uniformity of the sinter characteristics over trial data**. Also try to find the reason for the variation in the characteristics of sinter if it is significant.
2. Justify your results based on given trial experimental data and give appropriate explanation based on metallurgical point of view.
3. Consider the irregularity in sinter characteristics as data science problem and apply your data analysis knowledge to sort out the problem. Eventually you have to suggest streamlining the issue.

\*\*\*